

ESA-EPE:OP-001.0	<b>OPERATING PROCEDURE for METAL CLEANING</b>	February 24, 2000
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## **1.0 PURPOSE/SCOPE**

Prior to filling and testing, heat-pipe assemblies require cleaning, and the type of metal defines what procedures are used for that cleaning. These cleaning procedures use high temperatures, vacuum firing, solvent/degreasers, caustic solutions, alcohol, and a molten salt bath.

## **2.0 LOCATION**

This operating procedure covers the metal cleaning activities within the ESA-EPE Thermal Engineering Team at TA-46, Building 1, room 118. The work will be done in or near the fume hood.

## **3.0 HAZARD CONTROL PLAN REFERENCE**

This procedure is for use with the Thermal Engineering Team Hazard Control Plan (HCP), ESA-EPE:HCP:00-007.0. All hazards, controls, risk assessment, required training, and worker authorization are covered under the HCP. Workers performing this procedure must understand all hazards and controls and be authorized to perform work under the above HCP.

## **4.0 MATERIALS AND TOOLS.**

The following are required to perform this procedure:

### Lab Supplies:

Beakers, Dip Containers, scale, fume hood, hot plate.

### Chemicals:

deionized water, sodium hydroxide, hydrogen peroxide, sodium nitrate, potassium dicromate, iron chloride, PF Solvent/Degreaser, Kolene<sup>®</sup> DGS<sup>®</sup>

## **5.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)**

The following PPE must be worn during preparation, performance and clean-up for this procedure:

Safety glasses, face shield, thermal gloves and protective gloves for corrosives, long-sleeved lab coats, and safety shoes.

## **6.0 PROCEDURES FOR METAL CLEANING**

The procedures shall only be used when instructed by the responsible supervisor.

Overview: The molten salt bath has a thermal hazard and while it is basically nonflammable and will not burn, it contains an oxidizer that will support combustion under certain circumstances. A thorough review of the MSDS and the above referenced HCP will be conducted prior to starting the procedure.

Waste solutions will be collected in appropriate containers, placed in the satellite accumulation area, and disposed of according with guidance from the waste management coordinator.

### **6.1 CLEANING SOLUTIONS USED**

Refer to specific metal being cleaned.

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## **6.2 METAL CLEANING**

### **6.2.2 STAINLESS STEEL**

The following procedure applies to austenitic stainless steel used in the assemblies in the as-milled condition. This includes screen and wire cloth used in heat pipes, tubing, plate, and other forms of materials that, although machined in part, contain a surface(s) in the as-milled condition.

The cleaning procedure shall be as follows:

- 6.2.2.1 Fully immerse piece in PF Solvent/Degreaser and clean using ultrasonic cleaning unit until all signs of grease have been removed.
- 6.2.2.2 Fully immerse the piece into a caustic cleaning solution consisting of 11 parts water with one part sodium hydroxide and one part hydrogen peroxide and soak the piece for five minutes.
- 6.2.2.3 Remove the piece from the caustic cleaner bath.
- 6.2.2.4 Rinse piece in hot tap water.
- 6.2.2.5 Repeat steps 2-4 three times.
- 6.2.2.6 Fully immerse the piece in distilled water and soak for five minutes using ultrasonic cleaning unit.
- 6.2.2.7 Fully immerse the piece in ethanol and soak for five minutes using ultrasonic cleaning unit.
- 6.2.2.8 Proceed to vacuum degassing.

### **6.2.3 MOLY**

The following procedure applies to all Moly parts used in the assemblies in the as-milled condition. This includes screen and wire cloth used in heat pipes, tubing, plate, and other forms of materials that, although machined in part, contain a surface(s) in the as-milled condition.

The cleaning procedure shall be as follows:

- 6.2.3.1 Fully immerse piece in PF Solvent/Degreaser and clean using ultrasonic cleaning unit until all signs of grease have been removed.
- 6.2.3.2 Fully immerse the piece into a cleaning solution consisting of equal parts hydrochloric acid and water and soak the piece for five minutes.

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6.2.3.3 Fully immerse the piece into a caustic cleaning solution consisting of 11 parts water with one part sodium hydroxide and one part hydrogen peroxide and soak the piece for five minutes

6.2.3.4 Repeat step three more times.

6.2.3.5 Fully immerse the piece in ethanol and soak for five minutes using ultrasonic cleaning unit.

6.2.3.6 Proceed to vacuum degassing.

#### **6.2.4 HAYNES 230 CLEANING PROCEDURE**

6.2.4.1 Fully immerse piece in PF Solvent/Degreaser and clean using ultrasonic cleaning unit until all signs of grease have been removed.

6.2.4.2 Fully immerse the piece into a 74°C solution of 17% by volume of sulfuric acid, 1% by volume of hydrochloric acid, balance of water and soak for three minutes.

6.2.4.3 Rinse by fully immersing the piece in deionized water.

6.2.4.4 Fully immerse the piece into a 71°C solution of 8% by volume nitric acid, 4% by volume hydrofluoric acid and balance of water and soak for 25 minutes.

6.2.4.5 Rinse by fully immersing the piece in deionized water.

6.2.4.6 Rinse by fully immersing the piece in ethanol.

6.2.4.7 Proceed to vacuum degassing.

#### **6.2.5 MA 754 CLEANING PROCEDURE**

6.2.5.1 Fully immerse piece in PF Solvent/Degreaser and clean using ultrasonic cleaning unit until all signs of grease have been removed.

6.2.5.2 Rest the piece on alumina spacers placed inside a quartz tube then place inside the furnace. Anneal the piece at 1000°C in air for one hour. Allow to cool exposed to surroundings.

6.2.5.3 Fully immerse piece for 10-15 minutes in Kolene DGS which has been preheated to 488°C.

6.2.5.4 Quench the piece by fully immersing in deionized water.

6.2.5.5 Preheat one part sulfuric acid with five parts water to 80°C and fully immerse piece for five minutes.

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6.2.5.6 Fully immerse the piece in deionized water to rinse.

6.2.5.7 Preheat a solution of three parts by volume nitric acid with balance 10 parts water to 70°C and fully immerse piece for five minutes.

6.2.5.8 Fully immerse the piece in deionized water to rinse.

6.2.5.9 Preheat 10 grams of iron, 315cc nitric acid, 34cc hydrofluoric acid, 1000cc balance water and fully immerse the piece 10 seconds. Repeat 10 s dips until shiny.

#### **MA 754 CLEANING PROCEDURE cont'd.**

6.2.5.10 Fully immerse the piece in deionized water to rinse.

6.2.5.11 Rinse by fully immersing the piece in ethanol.

6.2.5.12 Proceed to vacuum degassing.

#### **6.2.6 MA 956 CLEANING PROCEDURES (applies to pipe and gun-drilled materials)**

6.2.6.1 Fully immerse piece in PF Solvent/Degreaser and clean using ultrasonic cleaning unit until all signs of grease have been removed.

6.2.6.2 Fully immerse piece for 10-15 minutes in Kolene DGS that has been preheated to 488°C.

6.2.6.3 Allow Kolene to cool to 150°C before removing part.

6.2.6.4 To quench and rinse, use the tongs to fully immerse the piece in deionized water.

6.2.6.5 Preheat 7% by volume concentrated nitric acid, 2% by volume of ferric chloride ( $\text{FeCl}_3$ ), and balance five parts water by volume to 66°C and fully immerse piece for 2-5 minutes.

6.2.6.6 Fully immerse the piece in deionized water to rinse.

6.2.6.7 Preheat 10% by volume hydrochloric acid, 1% by volume nitric acid, and the balance of water to 66°C and fully immerse piece for 5-10 minutes.

6.2.6.8 Fully immerse the piece in deionized water to rinse.

6.2.6.9 Rinse by fully immersing the piece in ethanol.

6.2.6.10 Proceed to vacuum degassing.

## **7.0 ATTACHMENTS**

### **7.1 Material Safety Data Sheets for Kolene DGS® and PF Solvent/Degreaser**